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STATUS, TRENDS OF OSI, ISDN

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JAPAN

STATUS, TRENDS OF OSI, ISDN

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[Survey report on Status, Trends of Open Systems Interconnection (OSI) and Integrated Services Digital Network (ISDN) in Japan, Posts Research Institute of the Ministry of Posts and Telecommunications, Japan]

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Introduction

The rapid development of "informationization" and "networkization" in recent years has brought about great changes in various segments of society. This trend is particularly pronounced in the corporate world, where how to make the most effective use of information and telecommunications networks is an issue of ever increasing importance for business strategy. In this situation it is important, when considering information systems for the mailing business, to ascertain the trends in information and telecommunications networks.

The Posts Research Institute has conducted a survey, by mailed questionnaire and interviews, in order to ascertain the present state and future trends in the introduction of OSI and ISDNs by companies and other organizations in Japan. This survey has been conducted as part of a "research investigation concerning protocol standardization, etc. for ISDNs in the mail business (research concerning the optimization of information systems in the mailing business)," which has been under way since fiscal 1988. This report summarizes the results of this questionnaire survey and interview survey.

We hope that this report will serve as a good reference for the introduction of OSI and ISDN.

June 1990

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Data: Collection of questionnaire data
Survey forms
Interview worksheets

Chapter 1: Purpose of the Survey

With the remarkable development of information and telecommunications networks in recent years, more and more companies and organizations have come to acquire so-called "multi-vendor" systems, which are made up of equipment made by various different manufacturers, and this has led to more occasions for telecommunications between different types of equipment. Because each manufacturer uses a different network architecture, incompatibility of protocols is today a major impediment for users that wish to connect networks together.

In order to contribute to the building of future networks to be used by various business systems, as part of a two-year plan beginning in fiscal 1988 the Posts Research Institute has been conducting a "research investigation concerning protocol standardization, etc. for ISDNs in the mail business." One of the key research topics of this study is OSI, which stands for Open Systems Interconnection. As part of this study, we conducted a questionnaire survey and interview survey of, among others, companies listed on Section 1 of the Tokyo Stock Exchange from November 1989 to February 1990 in order to ascertain the state of standardization of protocols among companies, and how many of them have introduced OSI and ISDNs or plan to take up this matter in the future.

Chapter 2: Overview of the Survey

2.1 How the survey was conducted

2.1.1 Questionnaire

- (1) Sample size: 1,000 samples
(Itemization: Nine hundred samples were taken from corporations listed on Section 1 of the Tokyo Stock Exchange and from unlisted companies engaged in a wide range of business activities, and 100 samples were taken from large public bodies, local governments, etc.)
- (2) Who was surveyed: the division in charge of information systems in the sampled corporations, etc.
- (3) Survey method: mailed-in questionnaire survey
- (4) Survey period: November 1989

2.1.2 Interviews

- (1) Sample size: 45 samples
- (2) Who was surveyed: the division in charge of information systems in the sampled corporations, etc.
- (3) Regions surveyed: Sendai, Tokyo and Tokyo suburbs, Nagoya, Osaka, Fukuoka
- (4) Survey method: interview survey
- (5) Survey period: November 1989 - February 1990

2.2 Interview items

2.2.1 Questionnaire

- (1) Outline of the corporation
 - 1) Number of employees
 - 2) Capital
 - 3) Sales
 - 4) Type of business
 - 5) Number of EDP personnel
- (2) Connection between different types of equipment
 - 1) Connection level
 - 2) Whether VAN is used
 - 3) Whether difficulties were experienced
 - 4) Points causing difficulties
 - 5) Method of connection between different types of equipment
- (3) Connection with other companies' systems
 - 1) Whether connection is made with other types of equipment of other companies

- 2) Points causing difficulties
- 3) Connection methods
- 4) Future necessity for connection
- 5) Whether a VAN carrier is used

- (4) Coping with protocol standardization
 - 1) State of promotion
 - 2) Protocols handled
 - 3) Problems with standardization
 - 4) Whether there is an awareness concerning the need for standard protocols
 - 5) Topics in standardization
- (5) Coping with OSI
 - 1) Whether OSI is being promoted
 - 2) Equipment being promoted
 - 3) Whether a system conforming to OSI is being built
 - 4) Level of conformity to OSI
 - 5) Type of work involved
 - 6) Reasons for not using OSI
 - 7) What is expected of OSI
 - 8) Whether there are plans to introduce OSI
 - 9) Where OSI is introduced
 - 10) Schedule for introduction of OSI
 - 11) Position of the data handled by the OSI portion
 - 12) Problems in introducing OSI
 - 13) Handling of portions not planned to be standardized by OSI
- (6) Coping with ISDN
 - 1) Plans for using ISDN
 - 2) Places involving the company's own network
 - 3) Mode of telecommunications of data used by ISDN
 - 4) Reasons for not using ISDN
- (7) State of network of surveyed corporation
 - 1) Network pattern
 - 2) Number of nodes making up the network
 - 3) Data processing mode
 - 4) Protocol used
 - 5) Reason for selecting the protocol
 - 6) Whether there is protocol conversion
 - 7) Whether there are overseas connections
- (8) State of manufacturers used
 - 1) Number of manufacturers used classified by equipment
 - 2) When multi-vendor purchasing began to be used
 - 3) Future plans for adopting multi-vendor purchasing
 - 4) Equipment to be made multi-vendor in the future

2.2.2 Interviews

- (1) Network configuration
- 1) Manufacturer
- 2) Equipment model
- 3) Number of units
- 4) Types and sizes of work-system and telecommunications-system software involving networks
- 5) Whether there are connections with overseas
- 6) Outline of the work done via the network
- 7) Difficulties when the network was put together
- 8) Problems with the actual network
- 9) Future orientation of the network (new work, connection with abroad, expansion of the LAN)

- (2) Coping with OSI
- 1) Basic philosophy
- 2) Outline of planning for conversion to OSI
- 3) Problems in planning for conversion to OSI
- 4) Outline of OSI application systems

- (3) Coping with ISDN
- 1) Basic philosophy
- 2) Outline of ISDN planning
- 3) Problems in ISDN planning
- 4) Demand for ISDN

- (4) Coping with protocol standardization
- 1) Necessity of standardization
- 2) Specific way of coping

- (5) Outline of the corporation
- 1) Number of employees
- 2) Capital
- 3) Sales
- 4) Type of business
- 5) Number of EDP personnel

2.3 Questionnaire response rate

In response to 1,000 questionnaires sent out, 343 effective replies were received.

Chapter 3: Survey Results

3.1 Questionnaire

(1) Profile of the companies that responded

The companies surveyed are large, being mostly corporations that are listed on Section 1 of the Tokyo Stock Exchange (Figure 3-1). On average, a surveyed company has 5,000 employees (staff) (Figure 3-2), capital of about 29 billion yen (Figure 3-3), and sales of about 350 billion yen (in each case for companies that are juridical persons) (Figure 3-4). In types of business there is an appropriate dispersion (Figure 3-5).

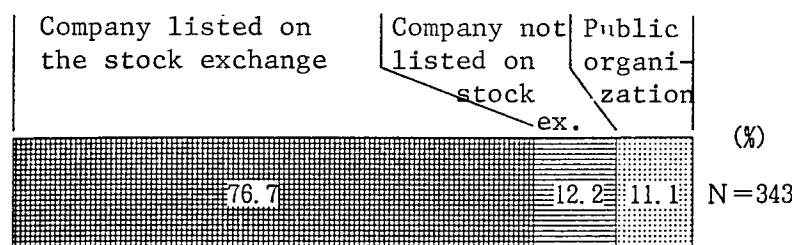


Figure 3-1. Classified by whether a listed company, unlisted company, etc.

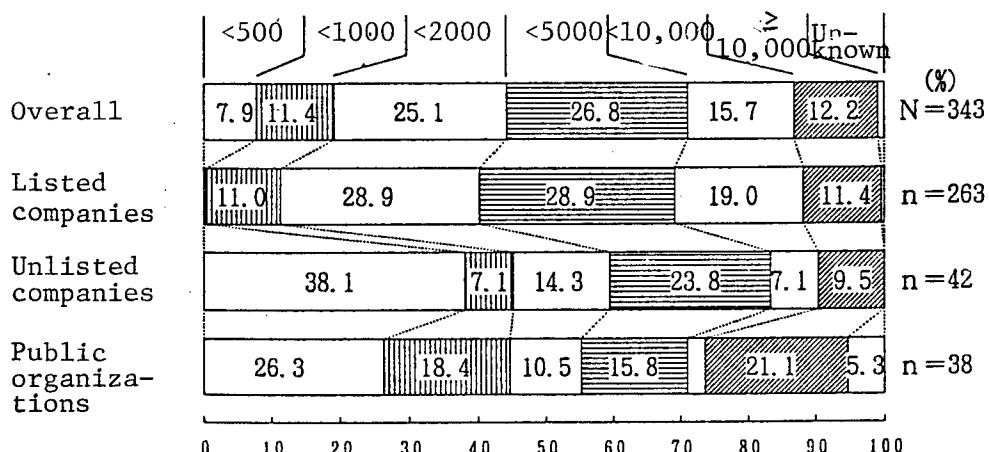


Figure 3-2. Number of employees (number of staff members)

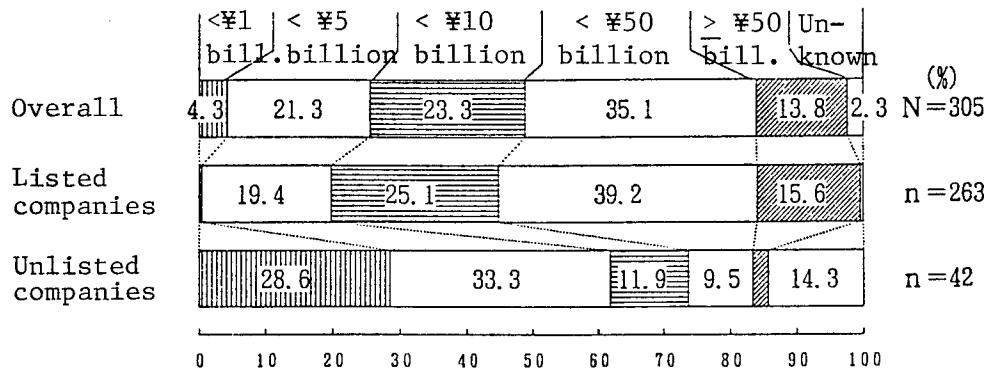


Figure 3-3. Capital (juridical persons)

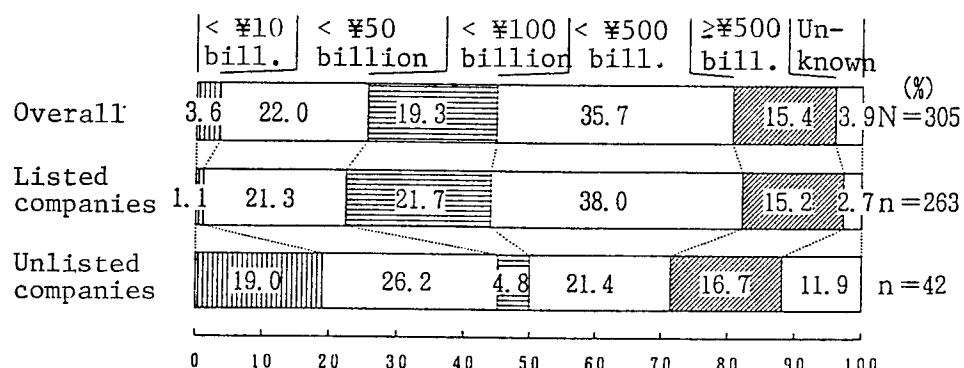


Figure 3-4. Sales (juridical persons)

		(%)
1	Marine products and mining	(0.3)
2	Construction	(9.3)
3	Foods	(2.6)
4	Fiber and paper	(4.4)
5	Chemicals and oil	(9.9)
6	Rubber and ceramics	(2.6)
7	Steel and metals	(8.2)
8	Machinery	(6.1)
9	Electric	(9.9)
10	Transport and precision	(5.8)
11	Various industries	(3.5)
12	Commerce	(6.7)
13	Finance and insurance	(5.8)
14	Real estate	(0.3)
15	Communications, shipping	(5.0)
16	Electric power and gas	(2.0)
17	Services	(5.2)
18	Public services	(6.1)
19	Others	(5.8)
20	No reply	(0.3)

Figure 3-5. Types of business

(2) Number of EDP personnel

The overall average number of EDP personnel engaged in system management and operation of the principal work is 56.1 (Figure 3-6). The number of persons is higher among unlisted companies because many software- and system-related companies were selected in these strata.

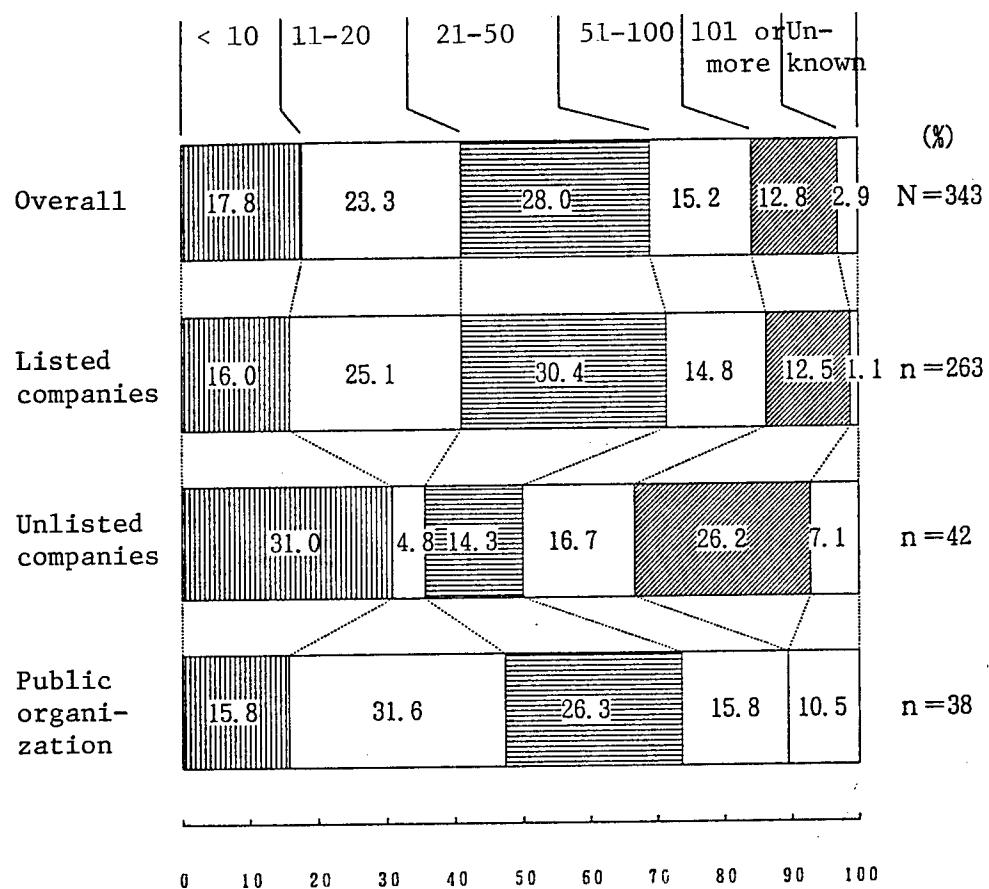


Figure 3-6. Number of EDP personnel

(3) State of the networks in use

N=343 (multiple replies)

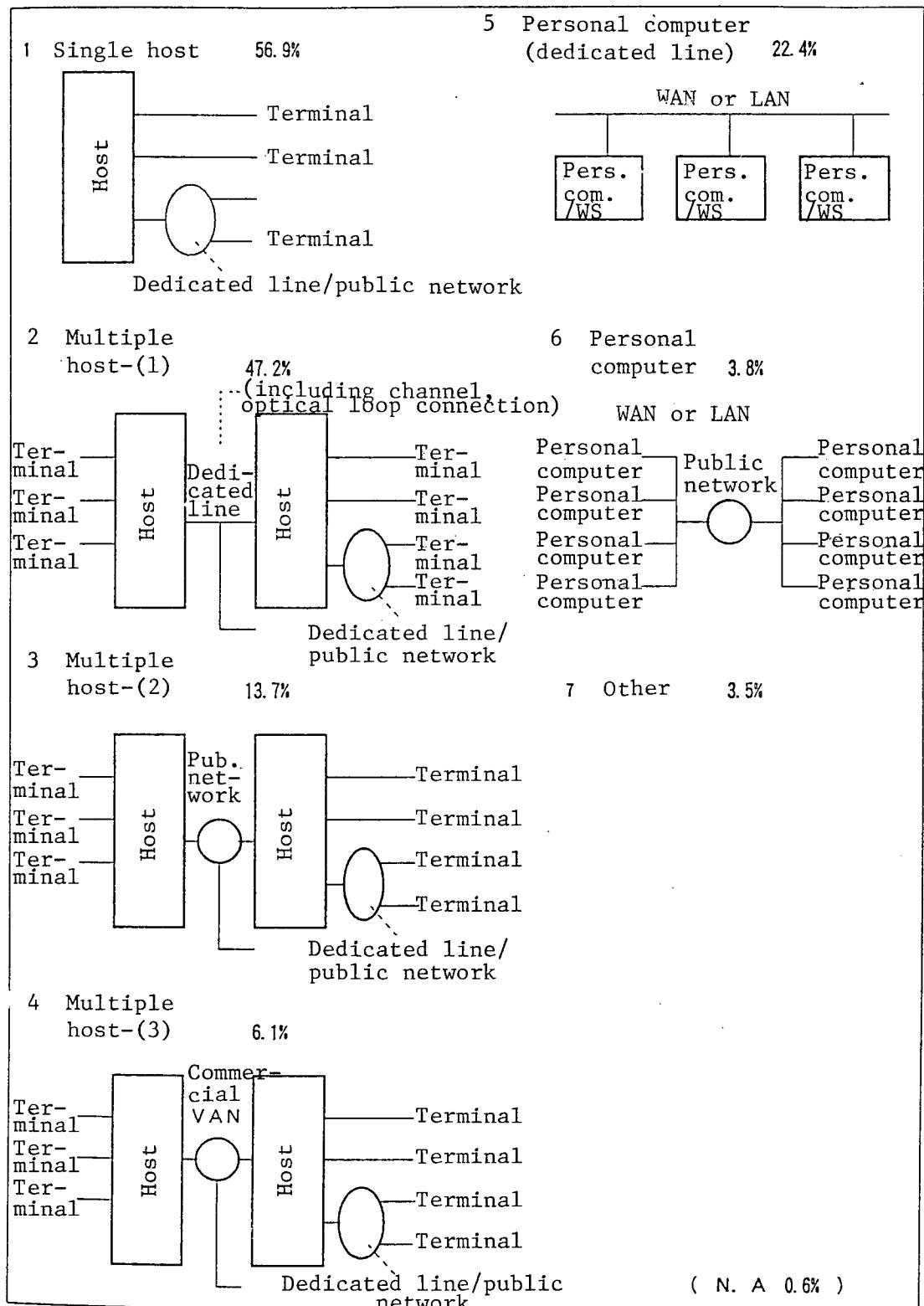


Figure 3-7. State of networks in use

(4) Processing mode

A host computer is at the center of most networks, and its main activity is file transfers and transaction processing (Figure 3-8).

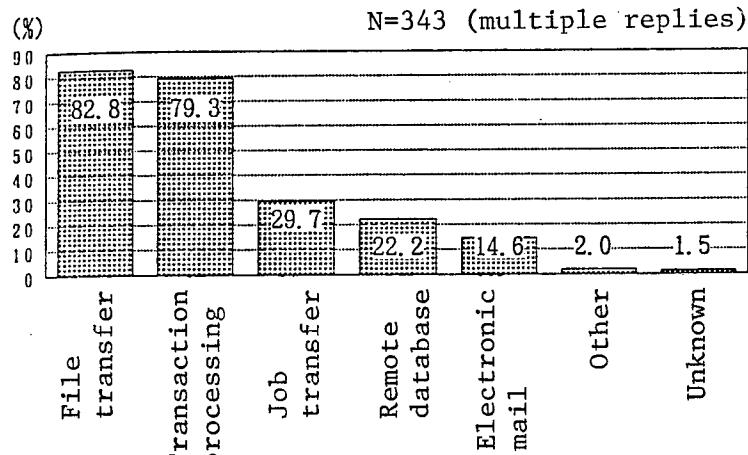


Figure 3-8. Processing modes

(5) Status of protocols used, etc.

a) Protocols used

The protocols presently in use are mostly those of the manufacturer's system; OSI is used in only 2 percent (Figure 3-9).

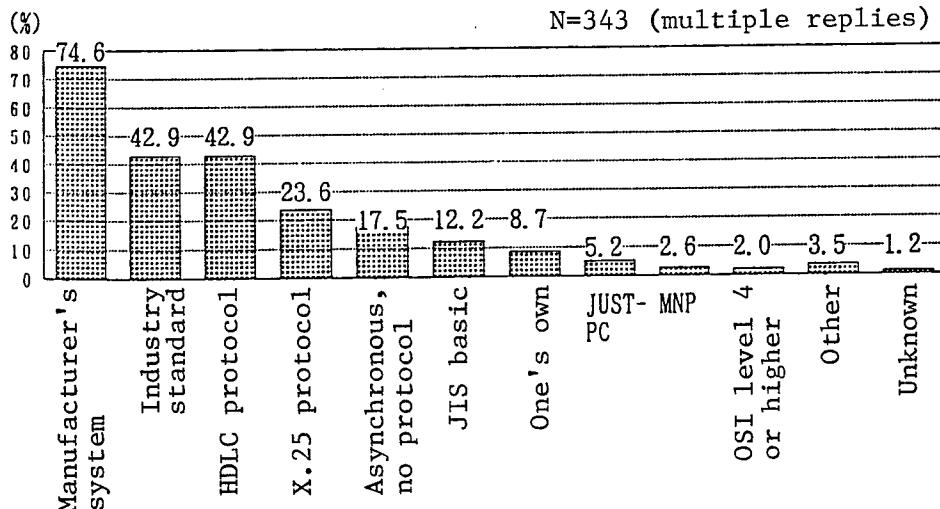


Figure 3-9. Protocols in use

b) Reason for selection of protocol

The majority are manufacturer-specified, but there is considerable interest in standardization as well (Figure 3-10).

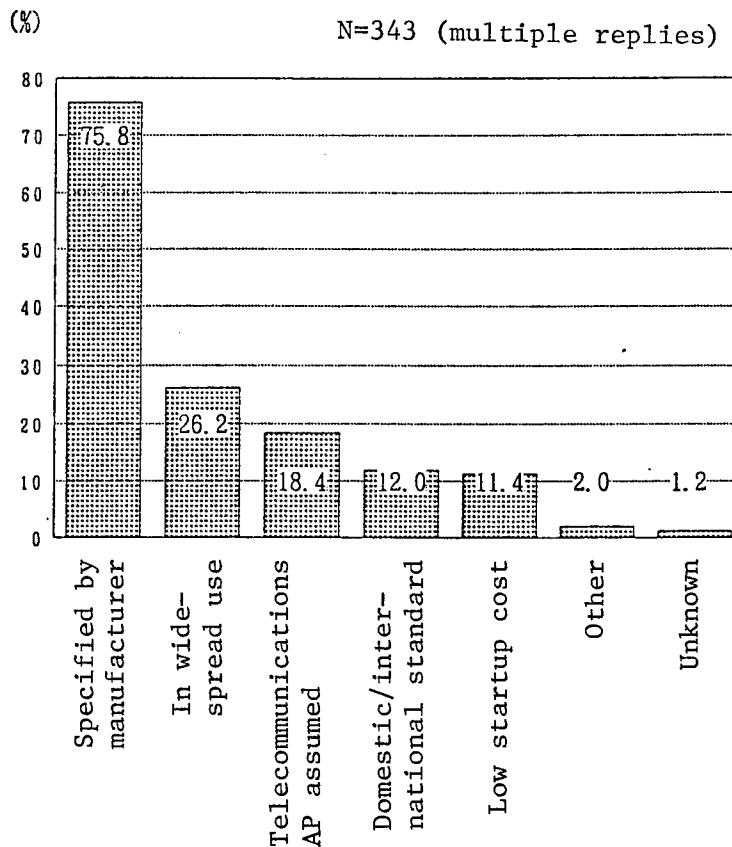


Figure 3-10. Reason for selection of protocol

c) Protocol conversion, etc.

About one company in three does protocol conversion (Figure 3-11). This agrees with the fact that in about 40 percent of the cases in this questionnaire a connection is made with another company's equipment of a different type.

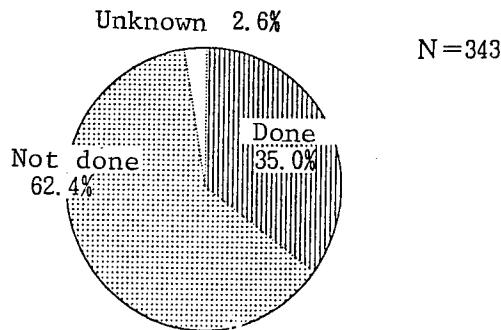


Figure 3-11. Whether protocol conversion is done

(6) Networks with foreign countries

Although the surveyed companies were relatively large, only about 20 percent had a connection with overseas (Figure 3-12). This is fewer than expected.

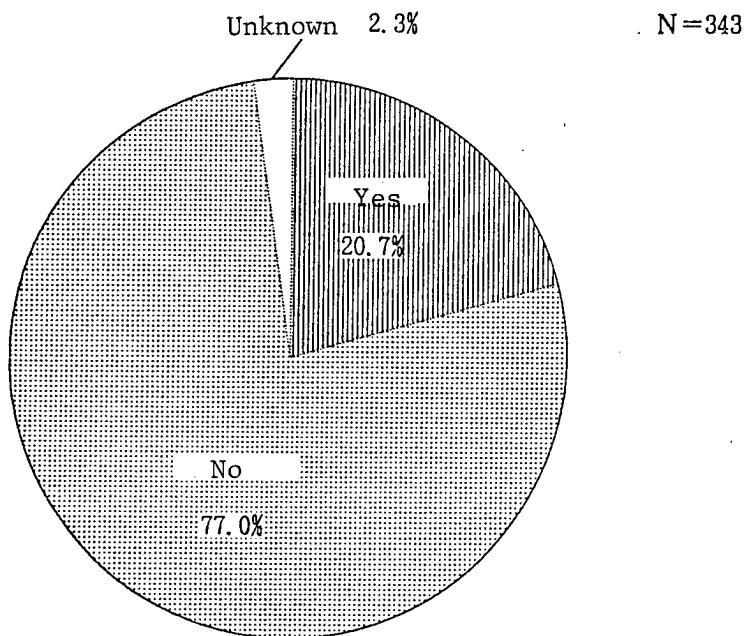


Figure 3-12. Whether there is a connection with overseas

(7) State of coping with protocol standardization

When we examine to what extent protocol standardization is being promoted within companies, we find that the majority "feel that it is necessary, but have not begun it." In most of the 30 percent of the companies (organizations) that are promoting protocol standardization the promotional activities are being led by the EDP department (Figure 3-13).

Many of the companies (organizations) promoting standardization have created their own specifications based on the manufacturer's architecture, but a third of them are considering OSI (Figure 3-14).

As problems in promoting standardization, many companies cite the lack of personnel and know-how (Figure 3-15, Figure 3-16).

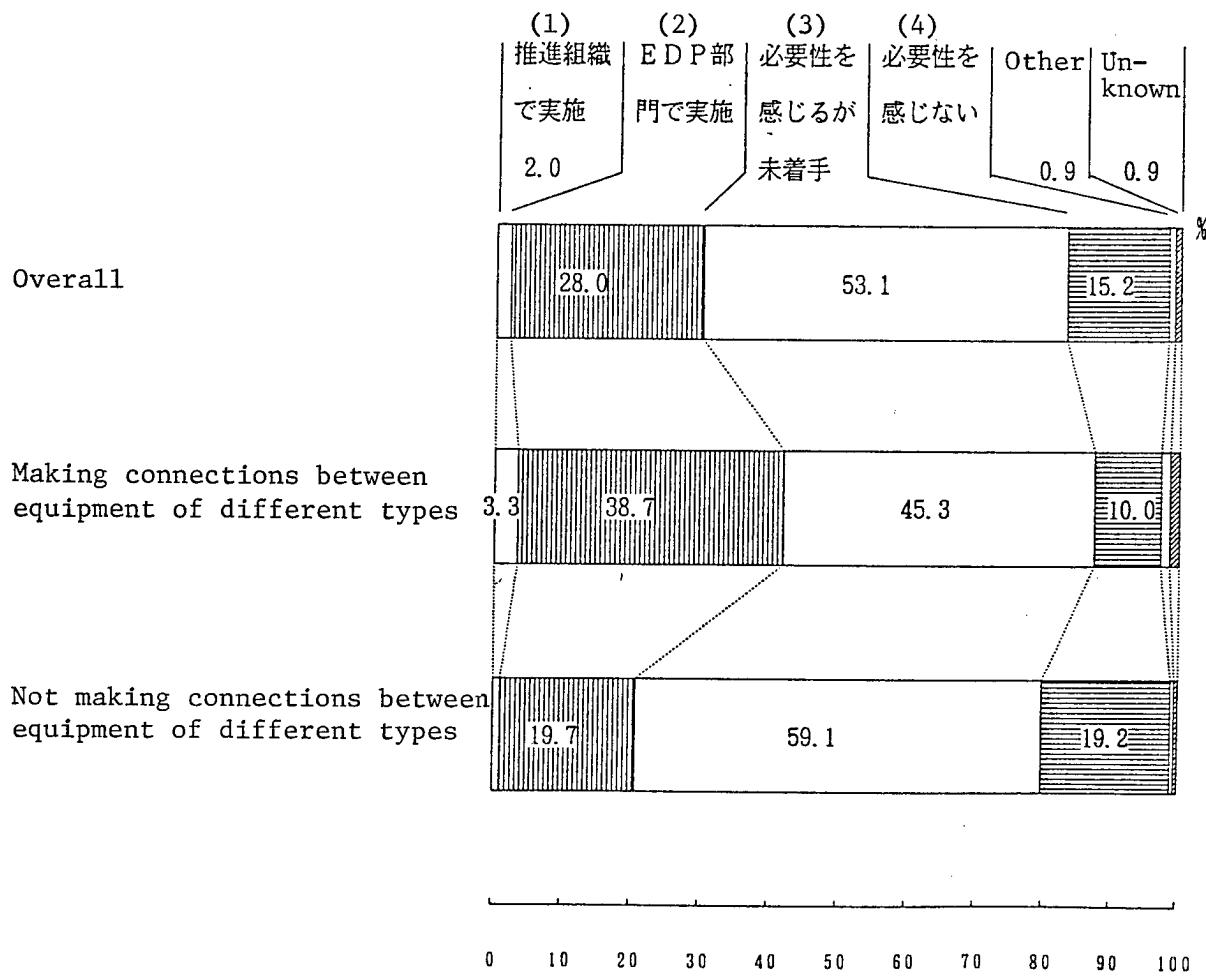


Figure 3-13. State of promotion of protocol standardization

Key:

1. Implementation by a promotion organization
2. Implementation by the EDP department
3. Feel the necessity for promotion, but have not begun it
4. Don't feel it is necessary

- Protocol to the company's own specifications based on the manu.'s architecture
- Industry standard with OSI in mind
- Own work-level specifications without OSI in mind
- Own work-level specifications with OSI in mind
- Extended protocol of the undefined portion of OSI
- Other
- Unknown

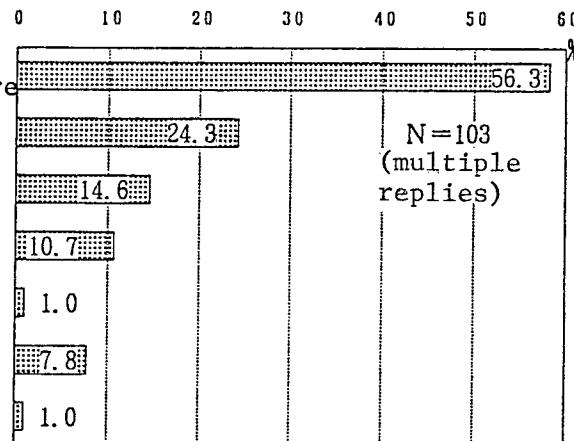


Figure 3-14. Protocols that are being promoted

- Lack of personnel and know-how
- Lack of focus of items to be standardized
- Standardization does not keep up with changes in the work
- Possibility of major modifications in the future
- No effective cooperation within the company
- Other
- Unknown

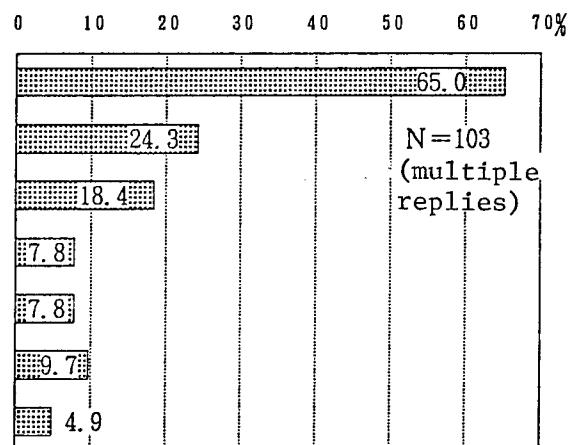


Figure 3-15. Standardization problems within the company

- Improvement of standardization technology
- Coordination of items to be standardized
- Provision of an organization within the company
- Organization of working conditions
- Educational activities concerning standardization
- Other
- Unknown

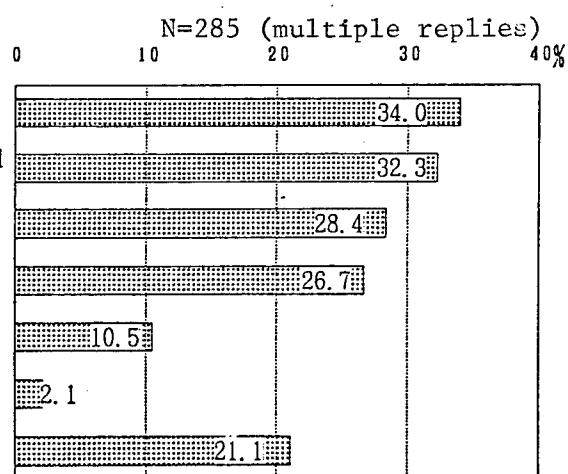


Figure 3-16. Standardization topics within the company

(8) Coping with OSI

a) Promotion of the introduction of OSI

The companies and organizations that are promoting the application of OSI to their system (either having already introduced it, in development, or in planning) are 8.7 percent of the total (Figure 3-17).

The equipment on which OSI is introduced is mostly general-purpose computers. This indicates that larger systems have a greater need for OSI (Figure 3-19 [as published]).

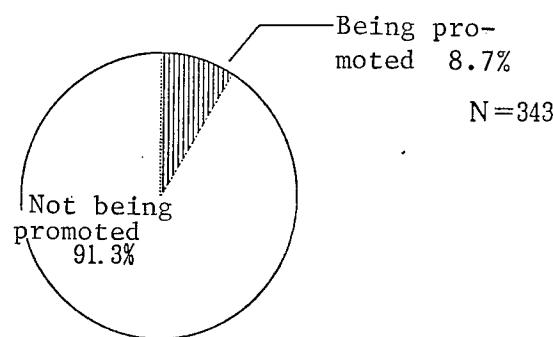


Figure 3-17. Whether conversion to OSI is being promoted

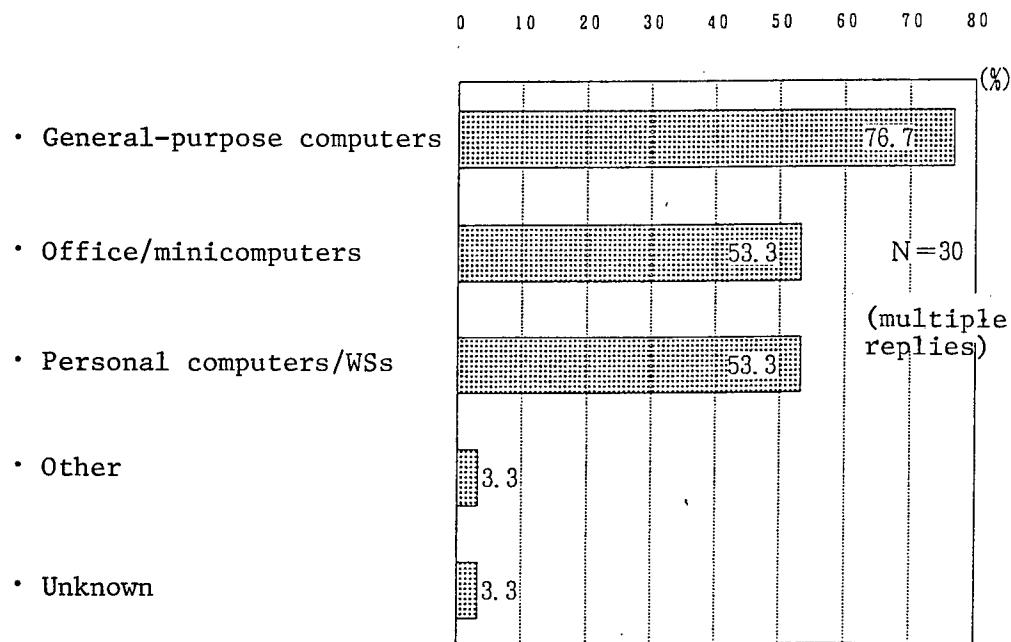


Figure 3-18. Equipment on which OSI is being promoted

b) Building of systems that use OSI

Companies (organizations) that have had experience in building systems conforming to OSI amount to only 5.8 percent of the total (Figure 3-19). It must be said that the widespread adoption of OSI has yet to begin. Also, most of the work converted to OSI is new (Figure 3-20), and there seem to be many cases involving levels up to level 3 (Figure 3-21). But the sample size is small, so it must be kept in mind that the sampling error is large.

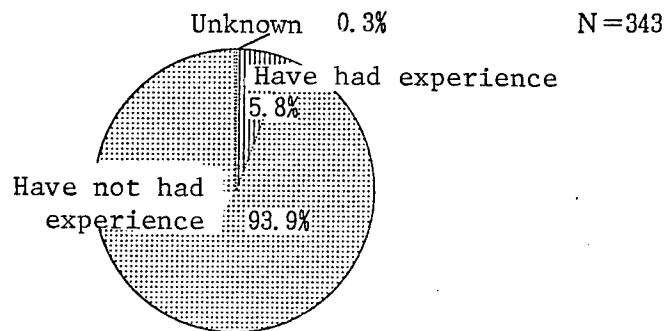


Figure 3-19. Experience in building systems that conform to OSI

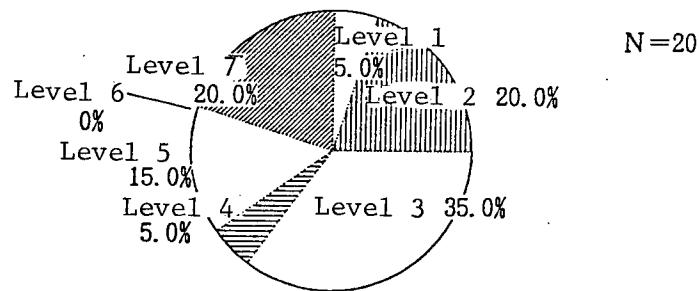


Figure 3-20. Involvement classified by OSI level

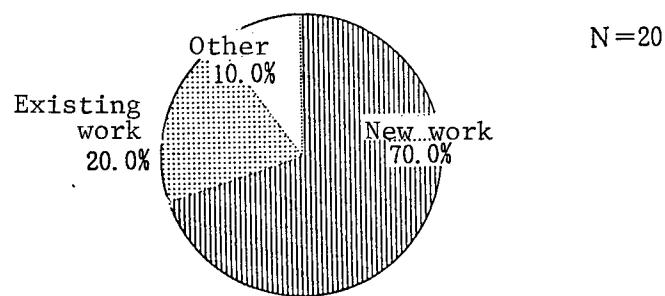


Figure 3-21. Work for conversion to OSI

c) Demand for promotion of adoption of OSI

About half the companies and organizations want to increase the number of OSI-compatible products and see early enactment of the undefined portion of the standardization (Figure 3-22). These two developments will be a big factor in the popularization of OSI, and action by manufacturers and international standard-setting organizations is desired.

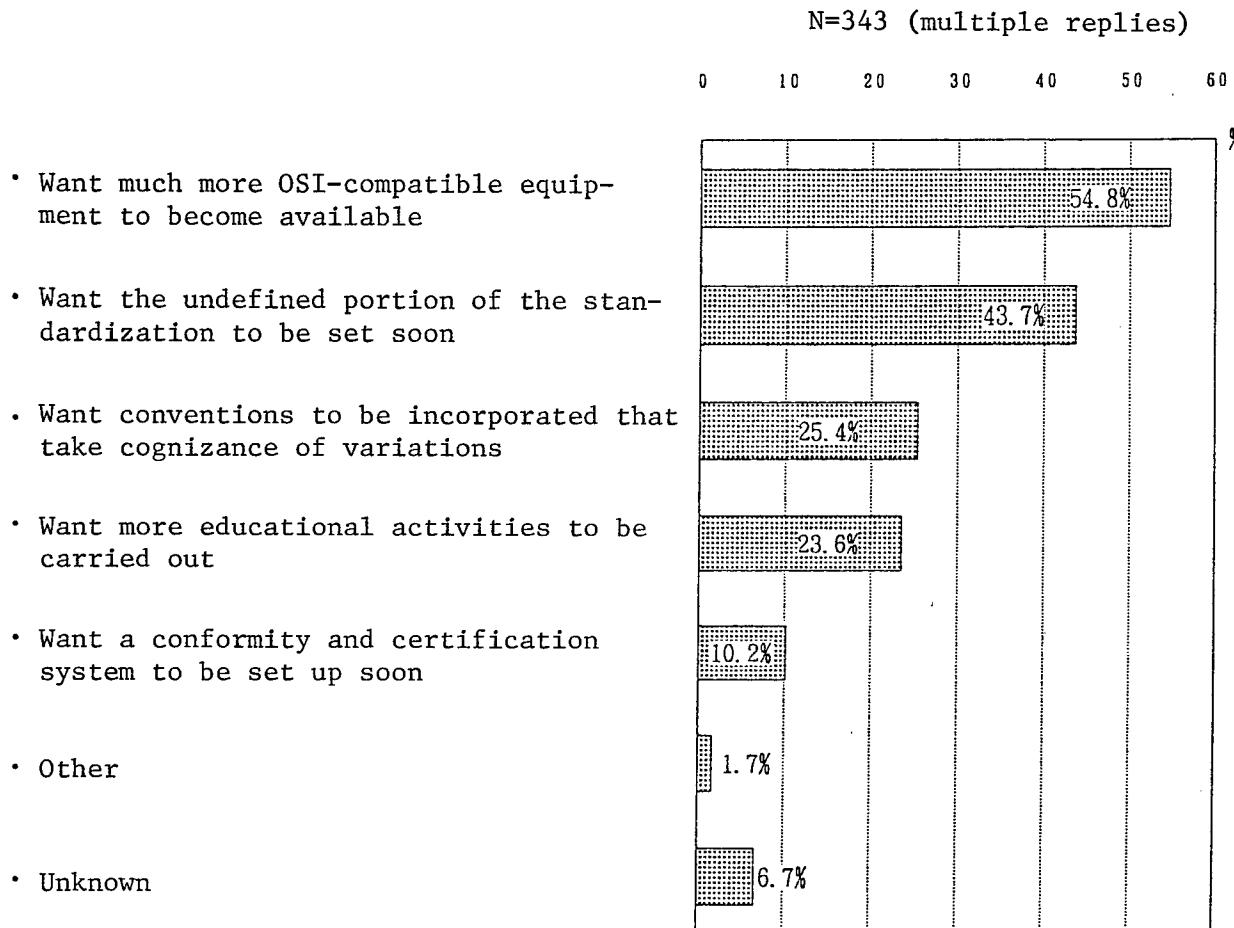


Figure 3-22. What is wanted of OSI

d) Plans for introducing OSI

About 15 percent of all the companies and organizations have plans to introduce OSI in the future, but among those that replied that connections with other models of equipment of other companies will become necessary within five years, about 20 percent are planning to introduce OSI (Figure 3-23). This shows that OSI assumes increasing importance to the extent that connection between equipment of different types is a topic for the near future.

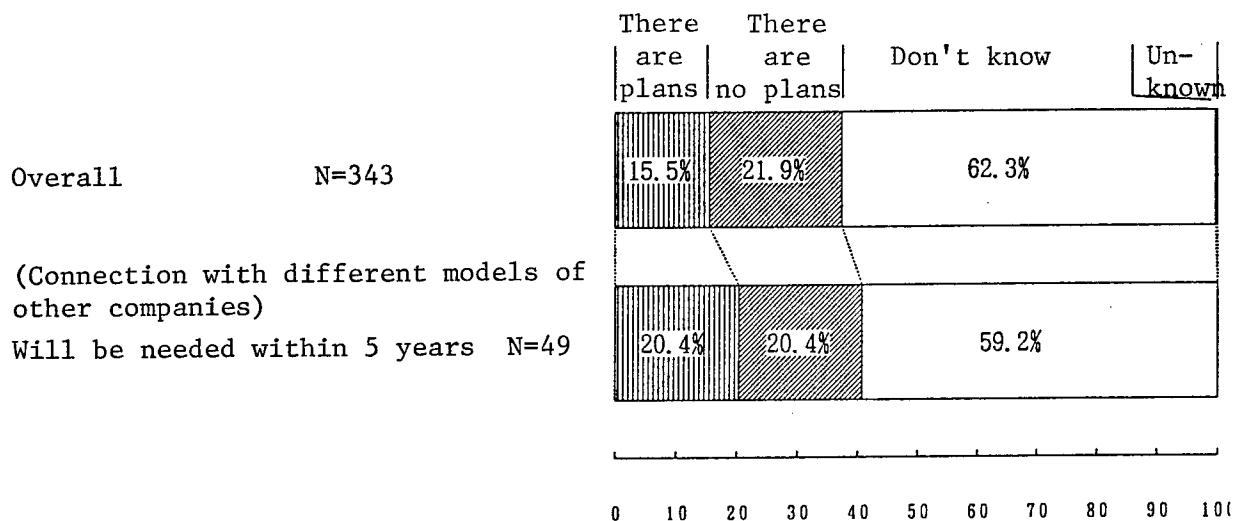


Figure 3-23. OSI plans for the future

e) What OSI is needed for

Center-end connection accounts for more than 40 percent of the parts for which OSI is to be adopted (Figure 3-24), and in about half the cases its introduction is to be effected within three years (Figure 3-25).

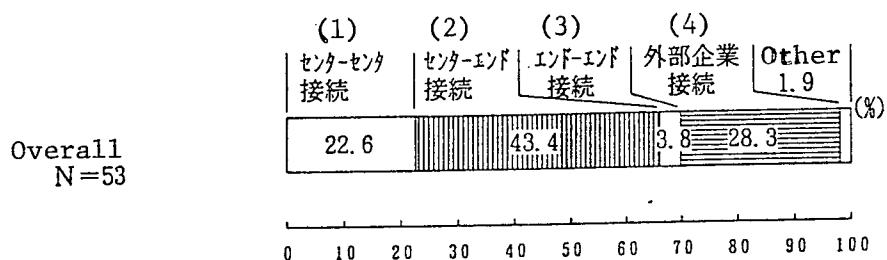


Figure 3-24. Parts to be converted to OSI

Key:

1. Center-center connection	3. End-end connection
2. Center-end connection	4. Connection with outside companies

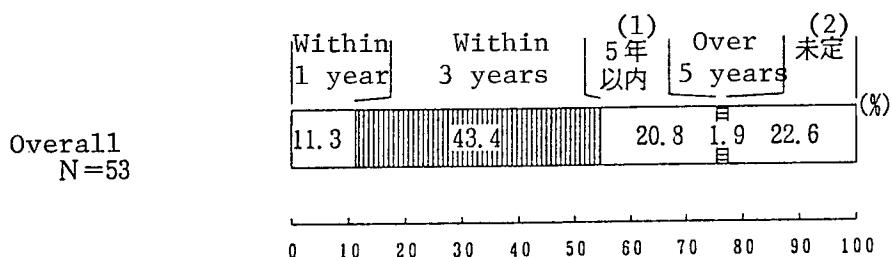


Figure 3-25. Schedule for introduction of OSI

Key:

1. Within 5 years	2. Not determined
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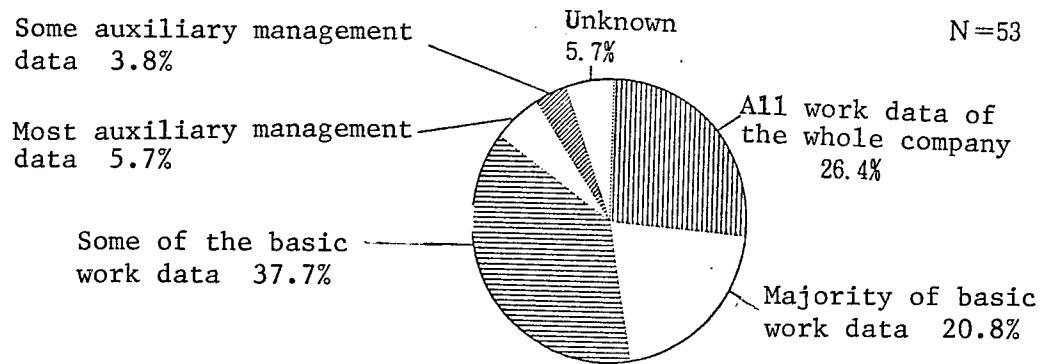


Figure 3-26. Position of data handled with OSI

(9) Coping with ISDN

Most companies, 67.3 percent, want to use an ISDN in the future (Figure 3-27), and they are to be used as basic and backup circuits (Figure 3-28). Their main modes of use are file transfer, G4 facsimiles, and high-speed personal computer and work processor telecommunications (Figure 3-29). Among the reasons for not considering an ISDN necessary are a limited service area, not seeing any advantage to one, and small data volume (Figure 3-30).

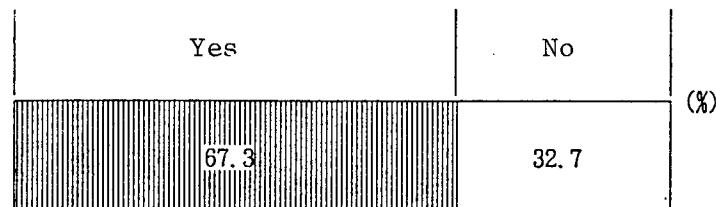


Figure 3-27. Whether there is an intent to use an ISDN

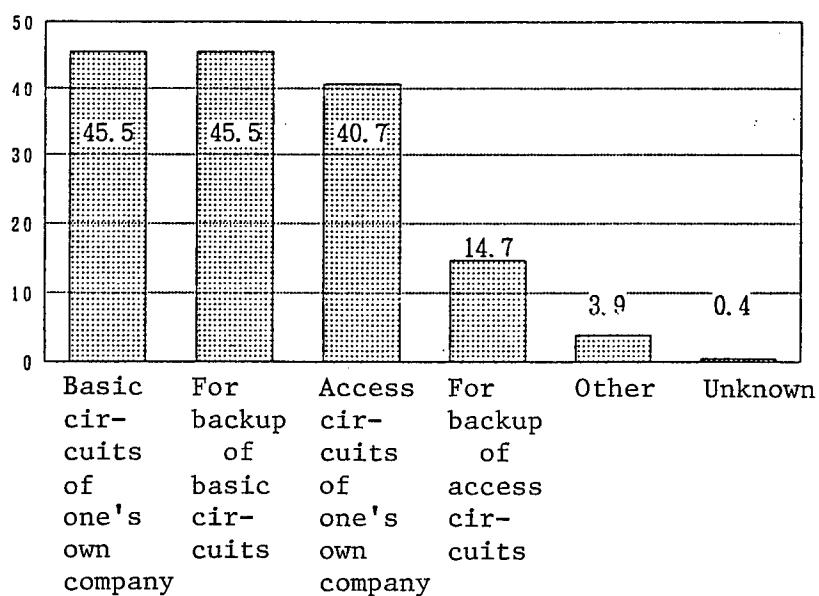


Figure 3-28. Parts for which an ISDN is to be used

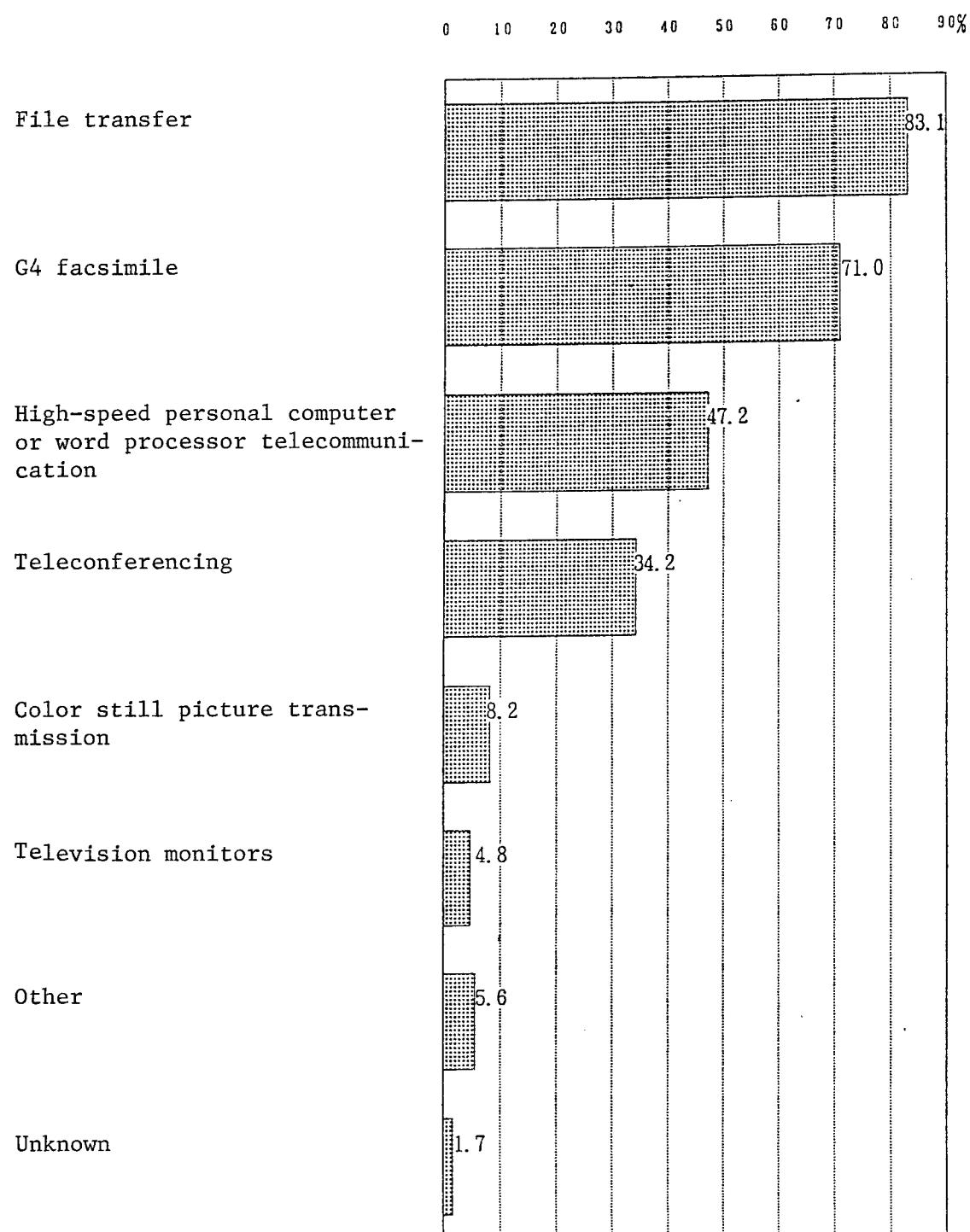


Figure 3-29. Mode of use of ISDN

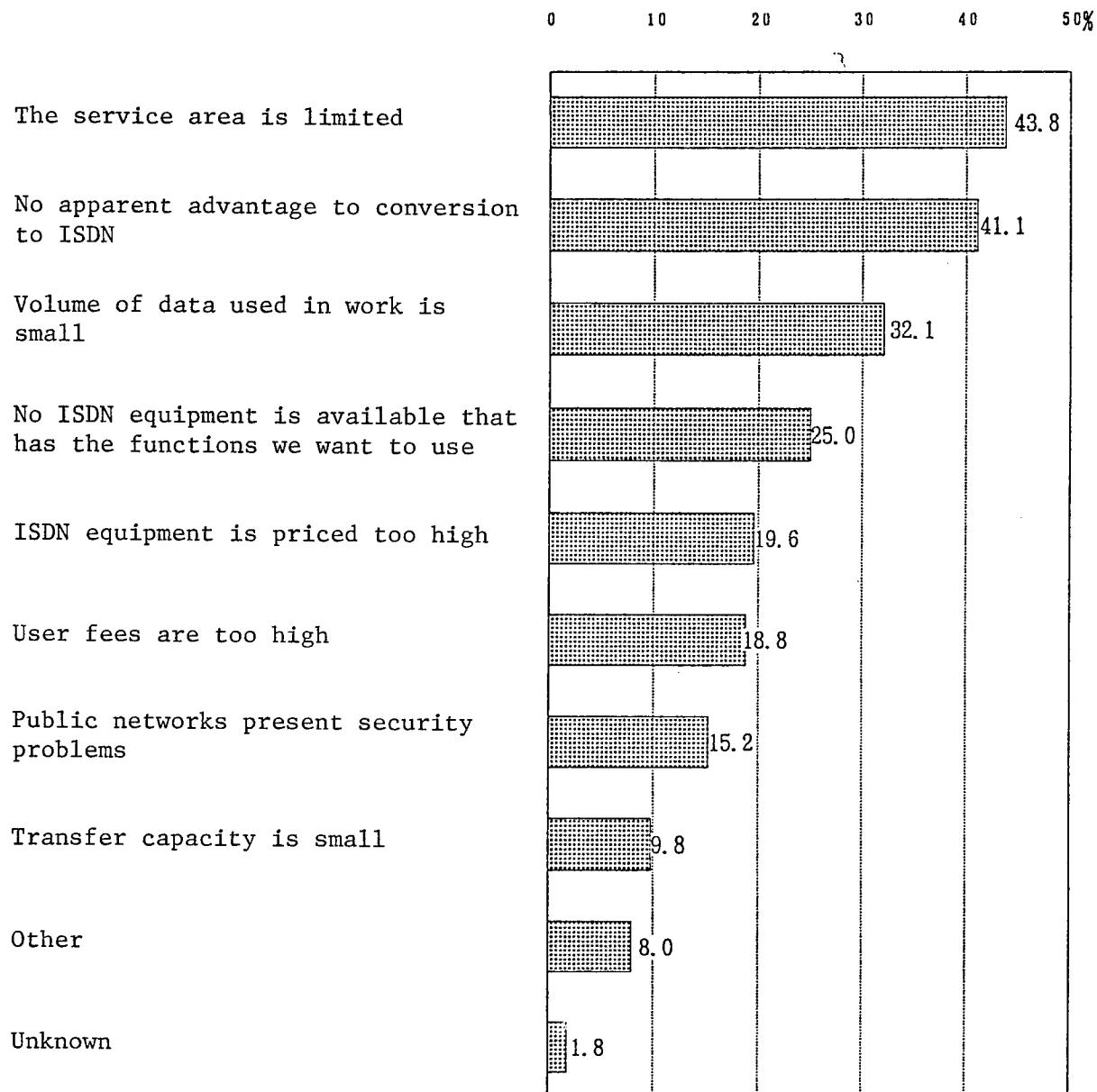


Figure 3-30. Reason for not considering ISDN necessary

3.2 Interviews

The interviews were conducted mainly to back up the results of the questionnaire survey but also reveal as follows some valuable opinions that can be elicited only in an interview survey.

(1) Policies toward OSI

All of the companies that now have multi-vendor systems, and even companies that use a single vendor, are greatly interested in OSI. Many single-vendor companies that intend to acquire multi-vendor systems are working on the assumption that they will adopt OSI. But many other companies are taking a wait-and-see stance, aware that it will not suffice just to make a judgment from future standardization trends and product development. And all companies are paying close attention to the interconnectivity that OSI will bring. It can be concluded that all the companies that introduced and are currently using OSI intend to expand their introduction of OSI to further areas and have great hopes for OSI.

Here we divide the respondents into three groups according to how positive they are toward the introduction of OSI -- "have already introduced it," "plan to or are actively introducing it," and "watching and waiting" -- and we discuss the main reasons for the decision of each group.

1) The group that has already introduced OSI

- * X.25 has been adopted for connection with the outside. Airline reservation systems use the joint network of the SITA aviation company, but its slow speed makes it difficult to instantly locate vacant seats on other airlines. Thus hope is placed on OSI. (transport)
- * The company would like to move toward OSI. In building a system not controlled by product strategy, the multi-vendor mode suggests itself, and the conclusion is for OSI. (electrical products)
- * OSI has been adopted in order to solve the problems that arise when connection is made with outside terminals. (public service)

2) The group that plans to introduce OSI or is actively introducing it

- * This group is aware of the issues, but there is a limit to the power of users, who must often depend on manufacturers. (service)
- * OSI should move on to practical arguments. OSI-compatible products are still not available, and being unable to wait till they are, these companies would like to build networks at their own expense, keeping OSI trends in mind. (transport)

3) The wait-and-see group

- * The number of connections with other companies is growing, and these companies feel the need for standardization. They are aware of OSI, but not of its specific content or what to do. Because multi-vendor systems, depending on their architecture, are possible, OSI offers hope. (food)
- * At present the protocol must match with the other party to the connection, and standardization is thought to be needed. But because study is required as to whether the network architecture now being used can continue to be used, these companies are presently in the stage of gathering information on the subject. (services)

(2) Future plans for conversion to OSI

Companies of a highly public character (electric power, gas, etc.) are conspicuous in having, in many cases, clear plans for introducing OSI. But there is a limit to how far they can effect their plans on their own, and most expressed the wish for more products and better system development support from manufacturers.

- * They are already connected with 1,000 user companies and are planning to go to level 3 (X.25) of OSI in two or three years.
- * In 1990 they plan to implement OSI for file transfer between hosts, LAN, and host-terminal online processing. (public service)
- * The company, being a multi-vendor shop, has a great need for protocol standardization, and the FTAM and MHS between host and server that is presently being tested is to go into full operation in October 1990. The intent is to ultimately standardize everything on OSI. (electric power)
- * As the first step in a conversion to OSI, OSI conversion plans are being drawn up for when the accounting system lines (terminal controller) are renovated in 1990-91. (financing)
- * There are still no specific plans, but there is a plan for building an experimental LAN system that adopts X.25 on three or four levels for mutual connection in FTAM next fiscal year. (steel)

(3) Issues in introducing OSI

The following opinions were expressed concerning issues of products and product providers in introducing OSI. They are considered important points in the popularization of OSI. The principal views are as follows.

- * The method of transition has not been decided. (financing)
- * The level of the software provided by each manufacturer is not known. The differences between new products and old products are not clear. And in adopting OSI, the division of responsibilities between manufacturer and user are not clearly delineated. (steel)

- * Even with the same OSI standard, there are differences between manufacturers in performance level, causing worry about compatibility trouble. (electric products)
- * OSI standardization is delayed. (transport)

Tables 3-1 through 3-3 present, for each group, how they are coping with OSI and the problems they face, and how they are coping with protocol standardization.

Table 3-1. Group of Companies That Have Already Introduced OSI

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
Gas	3	Introduced in spring 1989. As some sort of evaluation is made henceforth, the intent is to actively introduce it.	At present the information network within the company is unified on an IBM protocol, but data exchange, etc. is functionally not always satisfactory.	
Transport	3	Hope is placed on OSI. Interconnection between reservation systems in the airline industry has been a fact for some time, but this is done via the common network of an aviation company called SITA. Being a teletype system, this communication system is slow, and it is difficult to instantly find empty seats on other airlines.	A need for standardization is felt. The airline industry is moving toward IATA standardization, and within the company the standardization is toward unification on IBM's SNA.	

Table 3-1 (Continued)

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
Public agencies	3	<p>It is multi-vendor. The international standard OSI was necessary in order to solve the problems that arise when connection is made with terminals installed outside the agency.</p> <p>(1) Position of OSI conversion.</p> <ul style="list-style-type: none"> 1) Electronic question-posing between applicant's terminal and receiving host computer (operation) 2) File transfer between hosts within the agency. Back-end LAN. (1990) 3) Real-time processing in transactions between host within agency and terminals. Front-end LAN. (1990) <p>(2) Points emphasized in building the network.</p> <p>A dual structure was adopted for the back-end LAN to ensure that no collisions will occur even if files are transferred simultaneously.</p> <p>For use in instant processing, a separated mode was adopted to avoid degradation of response time caused by integration. It was decided that only file transfers would be done, keeping in mind the fact that in the event of LAN failure the same can be accomplished with the exchange of magnetic tapes.</p>		

Table 3-1 (Continued)

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
Local public bodies	3	When a new government building was constructed, an OSI-standard online system was built. But it differs from INTAP in the transport and network level of the WAN portion. Because of this, products were not obtained from manufacturers, and equipment had to be developed independently. The actual introduction was quite troublesome. This is because no study was made beforehand of what to do in order to keep using existing working software assets and hardware assets such as terminals. Interfacing with OSI is not causing difficulties.	This is the first case of the next OSI standard, "Miyagi Prefecture Administrative Information Network Standard Protocol."	
Public bodies	4	Work software is being developed based on OSI standard specifications from the relevant public agencies. Up to seven levels are being mounted in order to effect TP for terminals. But even the TP mounting specifications unique to this system, because of their uniqueness, will cause future return problems. Also there is the need to quickly create an FTAM that can be mounted on terminals	Same as above	

Table 3-1 (Continued)

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
		for intercommunication between terminals and user hosts. There is also the problem that coordination is needed when trouble arises due to the fact that the levels of presentation and below are not fixed for all manufacturers.		
Financing	7	The decision to introduce OSI was made in about 1986, and its basic work portions went into operation in spring 1988. FTAM and TP are being carried out, but for the latter, the manufacturer's standard terminal control and a work protocol developed by the bank run under ACSE. The network administration is horrendous when there are multiple vendors.	From the long-held belief that a network must be flexible, the work header, which is the work-portion protocol, was in orderly shape at the time of the second-stage online plan.	
Electric power	2	Since November 1989 FTAM has been used for data transfer concerning operation management between the head office and the power station. The plan is to gradually expand its use to other power stations as well. Problems are that mounting conventions will conflict when outside connections	The data communication department is in charge of standardization and is promoting it. This department also decided upon the policy of OSI introduction.	

Table 3-1 (Continued)

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
		are made in the future, and that differences in OSI products provided by manufacturers will make connection difficult.		

Table 3-2. Group of Companies That Are Planning To Introduce OSI or Are Actively Introducing It

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
Public organizations	2	Hopes are high for OSI. The intention is to convert everything to OSI, although in stages and taking 5 years to do so. It is felt that there should be a little more activity between administrative agencies and manufacturers.	There is a strong need for standardization. It is thought that henceforth all systems should be built to international standards. Systems should be organized in such a way that users can ignore the telecommunications protocol. MHS is adopted for electronic mail.	
Financing	5	The basic trend is toward converting all systems to OSI. In the third-stage online plan inaugurated in 1984, the accounting system, which is the main part, was completed in March 1989. The parts remaining in the accounting system are the updating of the terminal controller and the updating of the	It is desirable to make everything a standard protocol. Although the need for doing so at the present stage is rather small, in consideration of future prospects it is being promoted along with the conversion to OSI.	

Table 3-2 (Continued)

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
		communications protocol. This work is planned for October 1990 to March 1991.		
Machinery	1	The company wants to move toward OSI. From the multi-vendor standpoint, the desire is to build a system that is not controlled by manufacturers' corporate strategies.	It is needed. At present, unification is being done by XNA [as published; SNA?].	
Electric power	4	OSI is promising. Basically we want to go in the direction of using OSI. For adopting OSI, not only is an international standard to be enacted, but the idea is to incorporate functional standards and ISP and to start with a version that has been conformability-tested. There are no firm plans to introduce OSI yet, but the above conditions for FTAM have largely been met, and it can probably be used as is. But for really implementing it, there are many misgivings in safety and operability unless "OSI management" is soon clarified and products are developed. It is hoped that an environment that users will find easy to work in will be realized soon.	The awkwardness of making connections between machines of different types has underlined a pressing need for protocol standardization. The company is very interested in the trend toward standardization. It participates actively in OSI discussion groups and takes a forward-looking stance toward promoting it. The electric power industry is holding talks toward standardization with regard to business protocols. This is being actively promoted through the Electric Industry Federation. The host computers presently used by the various electric power companies are made by a variety of manufacturers, and progress	

Table 3-2 (Continued)

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
			is being made toward an awareness of and active use of OSI.	
Construction	3	Basically there is a desire to actively introduce something based on OSI. The reason for adopting Ethernet for the LAN is likewise because it is based on OSI, which is an international standard for LANs, and because it can support various protocols such as DSLINK (Fujitsu), XNS, DECnet, TCP/IP, and B4680 (NEC).	A need is felt. Henceforth the intent is to adopt a protocol that conforms to OSI as much as possible. At present there are subtle differences even in the same protocol, due to differences in interpretation by different manufacturers. This causes considerable difficulty when connections are made. Manual-level data must be made public.	

Table 3-3. The Wait-and-See Group

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
Trading companies	2	Standardization including upper levels is being done (for Japan), and a study will be begun on the introduction of OSI when products are all available.	Protocol standardization is not an urgent topic right now, because with computers it is not particularly troublesome to make connections between machines of different types. But there is a need for the rapid unification of transmission methods for multi-media multiplex equipment.	

Table 3-3 (Continued)

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
Chemicals	1	Unification on a worldwide standard would be very good, but it seems that in fact SNA and OSI may coexist. Since OSI is still not in a usable condition, for the present IBM has the more powerful position.	In considering the future, there is a desire to also use machines of different manufacturers, and then OSI offers hope. But because everything depends on HNA [as published; SNA?], including maintenance, there is only so much that one company can do. At present, each plant has installed its own LAN without coordination, but we would like to proceed toward standardization here.	
Steel	2	OSI offers hope. We want to adopt a standard protocol, but we don't know how much support we will get from manufacturers.	Standardization is needed for future expansion of the network. Regarding OSI, we are taking part in a working group of the OSI users discussion group.	
Local public bodies	3	There is interest on the level of personal interest, but no specific move is underway.	Generally speaking standardization is needed, but the present situation is not one of distress.	
Chemicals	2	We are not actively considering the matter. The basic parts of the system are all left to the manufacturer, and IBM seems not to be very active in this. User interest is on the level of collecting relevant information.	Of course there is a need for it, but right now all the systems in the company conform to IBM, and mostly SNA is used for connection with the outside. But if OSI proves to be very good, we will set up an interface for it.	

Table 3-3 (Continued)

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
Transport	1	<p>We are only gathering information on this. It will still be a while before OSI becomes a practical reality. We anticipate that problems such as failing to make contact will arise even if we actually connect OSI products.</p> <p>Even in the LAN field, a user that expects the transition from TCP/IP to OSI to take some time will have doubts about taking the step of introducing OSI and having to abandon its present software assets.</p> <p>From the standpoint of OSI performance, perhaps the hierarchical organization will lead to performance problems.</p>	We are doing nothing beyond standardization. That is a problem for the future.	
Insurance	3	<p>At present we are in the stage of learning about OSI; we have not entered the stage of specific study. Right now we do not see a need for OSI. We have multiple vendors, but the main one is IBM, and our Hitachi and Fujitsu machines are used in a subsidiary role. This is because basically the manufacturer takes care of the communications protocols.</p> <p>We think the trend toward multiple vendors</p>	There is no need for it at the present time, but a need might arise in the future along with the possibility of using multiple vendors. In the future we might not be able to use vendors that cannot handle standard protocols.	

Table 3-3 (Continued)

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
		<p>will advance. Different manufacturers are good in different areas, and users will want to pick and choose among them. What is important then is to have a standard protocol, and we think that will be OSI. The various manufacturers are actively dealing with OSI, and we think it possible that we will not be able to use manufacturers that cannot handle OSI.</p> <p>At present we are not actively contemplating the introduction of OSI.</p>		
Commercial companies	3	<p>OSI is a major trend, and in the stage of system construction there was a trend toward adoption of HDLC.</p> <p>But it is difficult to adopt OSI in a system that has already gone into service.</p> <p>We will wait to see what happens.</p>	<p>Today's networks are in a certain sense closed networks, and to that extent there is no need for standardization. But in the future when it comes to making direct contact with general consumers, standard protocols will necessarily become important.</p>	
Insurance	3	<p>Thus far we have relied upon the manufacturer (Fujitsu) for communications protocols, and because we are not a multi-vendor shop and seldom make connections with outsiders, we have no particular awareness of OSI. Some people study it as individuals, but we are not yet involved with it as a company.</p>	<p>In the company a protocol exchange is done between the host and FER, and we feel a need for standardization. But we already have an SNA-based network and are not contemplating changing it over to OSI. For the present we are taking a wait-and-see attitude.</p>	

Table 3-3 (Continued)

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
		<p>Although we cannot say that OSI will never be introduced in the future, for the next several years our system will basically be an extension of the present one, so in that sense it can be said that we will not be adopting OSI.</p> <p>Although nothing definite can be said, maybe OSI will become necessary if customers start making direct access.</p>		
Service	1	<p>We have a closed IBM network and have not yet felt any need for OSI. If it does become necessary, it will be for connection with banks and various industries. We have no intent to actively deal with OSI, but we will respond to the situation.</p>	<p>Where we now feel a need for it is in connections with the outside, but we are watching and waiting rather than actively seeking protocol standardization.</p>	
Electric power	6	<p>By its very nature, a power company cannot use just the equipment of one manufacturer. The major premise is that it must always be a multi-vendor shop. In this sense OSI, which is a worldwide standard, is something of a necessity. But we do not necessarily have the idea of working actively</p>	<p>The need can be said to be great. This may be a life-and-death matter for a multi-vendor company. Ultimately we would like to unify on OSI. But in many ways we must conform to the world and to the state of development by manufacturers, and nothing can be said about the speed of these developments.</p>	

Table 3-3 (Continued)

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
		<p>for OSI. Basically OSI is an issue that should be sustained mainly by the manufacturers, and our company acts so as not to be left behind in the world.</p> <p>We plan to put it in full operation between host and server in October 1990. Thereafter we plan to look into using OSI between hosts.</p> <p>Introducing OSI requires consideration of the existing network environment and the functions wanted by users. In March 1989 we ran tests for OSI connection. They were the following five types.</p> <ol style="list-style-type: none"> 1) MOTIS host-host (ODA) 2) FTAM host-host (ODA) 3) FTAM host-server (ODA) 4) FTAM server-workstation (ODA) 5) FTAM server-workstation (JISX0208-83) <p>In carrying out our future plans, various detailed issues are bound to arise, but we think there will continue to be coordination through meetings of manufacturers (Unisys, Fujitsu, Mitsubishi, Toshiba, NEC).</p>	We favor conversion to OSI, although to a certain extent we must leave this to the manufacturers.	

Table 3-3 (Continued)

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
Local public body	1	<p>In this prefecture there is a growing need for connection between machines of different types to cope with the trend toward multiple vendors in both hardware and software, so OSI, which is a worldwide standard, is a topic of interest.</p> <p>But basically this is a matter that is left to manufacturers to grapple with, and not for our prefecture.</p>	<p>In 1992 personal computers installed in various places will be linked by lines under a new fiscal plan. This will make it necessary to connect personal computers of four different types. At present we are doing research on this.</p>	
Insurance	6	<p>We are looking into this on an individual level. We have no plans to deal with this in an organization-wide way.</p> <p>The trend toward multiple vendors is a major one, and eventually it may become necessary to convert to OSI, but that is a far-off issue that in our judgment need not be considered yet for today's networks.</p>	<p>Although we are a multi-vendor shop, basically we have an IBM network, and we have not been feeling any great inconvenience in connecting it to outsiders (banks, etc.). It suffices to make a specific study at a future stage when standardization under OSI is a major development.</p>	
Transport equipment	3	<p>It is difficult to get OSI into wide use. Since we are not university researchers, the biggest issue for us is whether it presents advantages for the users.</p>	<p>We don't feel any particular need for it at present. Because our LAN uses closed vertical connection with each host, at present we have no particular need for standardization of protocols, but if in the future</p>	

Table 3-3 (Continued)

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
			we shift to an integrated network, standardization will become necessary. Then we might introduce OSI.	
Food	2	We are aware of this, but we haven't seen the specific content, so we don't know what should be done. A feature of OSI is that it makes it possible to have multiple vendors, so the construction of the system is self-directed rather than left to the manufacturer to decide. We have high hopes for OSI.	More connections are being made with other companies, and we feel a need for standardization.	
Land transport	4	Not every system is connected, so this is not such a big issue. OSI will become necessary if in the future we build a total system with WAN. Even then it will not be a serious problem, and we are not particularly worried about it.	Except for the MARS system protocol, we always use the standard protocol of each hardware manufacturer. The MARS protocol we developed ourselves; we use a half-duplex method. Standardization will become necessary if in the future we share databases, but until then it's enough just to keep up with version updates.	

Table 3-3 (Continued)

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
Chemicals	2	We are aware of the issue, but at present we are content not to introduce OSI. We hope that more interfaces and software along the lines of OSI will become available.	There is a need for protocol standardization. At present an ACOS system and a VAX system (Ethernet) are connected. We rely upon NEC for the development of this protocol, which implements OSI up to level 5.	
Food	2	We are aware of OSI and respond specifically to what the manufacturers (especially IBM) do and what direction OSI itself is heading in. Even though this may be a system integrator issue, users' responses will vary depending on the future power relationships among manufacturers. At present we must rely on IBM, but if other manufacturers become more powerful, the scope of system selection will expand, and it will become possible to have multiple vendors.	As long as the connections are mostly within the company as at present, there is no particular standardization problem. But it will be if in the future it becomes necessary to make connections with outsiders.	
Food	1	It is not particularly needed now.	At present we are not experiencing any inconvenience, but being a single-vendor shop, we must depend on the manufacturer, so we can't make cost comparisons. We want	

Table 3-3 (Continued)

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
			to use equipment from various manufacturers, which standardization will make possible.	
Service	3	<p>We are aware of it, and it is a very delicate problem. We must consider whether to continue with the manufacturer-system protocol that we are now using. If possible we would like to put the system, including its terminals, into an orderly form.</p> <p>Compared with the protocol we are now using, OSI will offer a fuller selection of hardware and software.</p>	Right now we have to adjust the protocol to match the other party with which we are connected (JAL, JR, etc.), so standardization is needed.	
Chemicals	3	<p>We are aware of this to some extent. We are conducting no particular study of OSI at this time. Even if we introduce OSI, we will still have to rely on the manufacturers (especially mainframes) to a considerable degree. Since we think it will take some time for OSI itself to come into widespread use, we view this as a problem for the future.</p>	We have not reached the point that our protocols have been standardized, nor is this a particularly urgent issue with us.	

Table 3-3 (Continued)

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
Financing	3	We are aware of this. A user has only so much power and must rely on manufacturers. In our packet switching network we have standardized with X.25 up to level 3.	We feel a need for protocol standardization. We have standardized up to level 3, and standardization in applications is a topic for the future.	
Chemicals	3	No matter how much a user wants to use OSI, he still has to rely on the manufacturer. We have our doubts about whether manufacturers really want to promote OSI.	We feel a need for protocol standardization. If possible we'd like everyone to agree on OSI, but in the present situation that would be very difficult.	
Rubber	1	We are interested in this, but have not yet taken any actual action.	There is not much necessity for standardization in our present stage, but in the future there will be more connections with other companies, and standardization will become an issue.	
Transport	3	OSI is shifting from a theoretical to a practical issue. As a plan for introducing OSI, we are contemplating handling up to level 3 for the present.	We are conscious of a need for protocol standardization. For our network we plan to unify on X.25 (packet) in two or three years for the trunk-line system.	

Table 3-3 (Continued)

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
Service	4	Because it is an international convention, a great deal of time will pass before the convention is definite. And even then it can be expected that there will be cases in which two pieces of equipment that both use OSI will not be able to talk to each other, because of differences between vendors on the subset level. IBM's SNA, which approaches a standard, is very influential, and it is doubtful whether another new standard will come into wide use.	The practical problem is just to get two machines to talk to each other. We have built our systems with IBM as a single vendor, making everything conform to IBM, including the OS. We think we will continue this policy, and we don't feel any particular need for standardization.	
Machinery	1	There is no particular need for this, because we use IBM as a single vendor. But users might expect OSI. Depending on how popular OSI becomes, in total cost a multi-vendor system might be cheaper than our present single-vendor system, and if so, we could switch to multi-vendor.	At present we are de-facto standardized on SNA. We can consider the issue again when OSI or some other new standard comes on the scene.	
Service	2	The actual state of OSI is not clear, so we are taking no specific steps in this regard. We are just waiting to see what kind of products manufacturers	There is no particular problem right now, because we are unified on SNA. Various problems arise on an individual basis, but they are solved	

Table 3-3 (Continued)

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
		will come up with. It will be a while yet before OSI comes up as a realistic subject.	through cooperation with the manufacturer. For example, when a retailer does master maintenance with the host computer in our computer center, the retailer may have a terminal made by any of a number of manufacturers. We handle this by SNA or asynchronous access using an emulator, although this does not always succeed in establishing a connection.	
Precision devices	2	We are interested in this. If a manufacturer comes up with a good-quality product, we might introduce it. Actually, we did consider OSI when building the network. But a lot of products were available around SNA, and they had something of a record of performance. From the user's standpoint, these two points cannot be dismissed. OSI seems to be still in the testing stage.	There is a need. For the present we will go with an SNA-based network.	
Commercial business	2	We are aware of the issue, but the protocols provided by the manufacturers are still more effective, and will be for some time. But in the	Protocol standardization is needed. We would like to see progress made in the standardization of business protocols in particular.	

Table 3-3 (Continued)

Industry to which the company belongs	Number of vendors	How the company is coping with OSI and the problems it faces	How it is coping with protocol standardization	Remarks
		future we are thinking of adopting OSI from a new proposal, and we want to take up the OSI issue with some alacrity.		
Machinery	1	<p>In our present work, we rely on the manufacturer, and no big problems have arisen. In the future we will have to make outside connection with other kinds of machines, namely NEC and Hitachi. Even then it won't be such a big problem; we will just talk it over with the other party to determine which procedure to use.</p> <p>IBM seems unlikely to abandon its present 3780 and 3270 procedures and embrace OSI.</p>	<p>It's not such a problem now. It's only a problem when connection is to be made between IBM and VAX, Sun, Apollo, Cray, etc.</p>	
Local public body	2	We are very interested in protocol standardization and OSI, but we are not able to do much because of a shortage of trained personnel and a lack of knowledge.	Same as above	

(4) Policies for dealing with ISDN

About 70 percent of the companies interviewed either have introduced an ISDN or are considering doing so. Almost all of the companies that have introduced an ISDN either use it as a backup line or are using multiple lines on a trial basis. In only a few cases is it a substitute for a dedicated line, and in some cases it could not be used for G4 faxes or teleconferencing.

Most of the other 30 percent of companies have some interest in ISDN, but for various reasons, such as unavailability of persuasive applications, are only watching the situation.

Here we divide the companies into three groups according to their degree of activity in introducing ISDN, and we list their principal views.

1) The group of companies that have introduced an ISDN

- * We set up one as a backup, but because of cost we cannot use it for G4 faxes or teleconferencing. Also, with teleconferencing there is no compatibility among manufacturers. (gas)
- * We have set up a line, but there are no prospects for applications for specific uses. (commercial business)
- * We use 60 lines of Net 64 and four lines of Net 1500 for cameras and G4 faxes for troubleshooting. We are also studying its use as a backup. (finance)

2) The group of companies that are planning to introduce ISDN or are actively introducing it

- * We would like to start introducing it beginning with something that is actually useful. At present we are doing CAD telecommunication with a dedicated line on an experimental basis, and if it succeeds we are contemplating a system that can be used with ISDN too. (distribution)
- * In fiscal 1992 we plan to switch over our financial online system from a dedicated line to public lines, and ISDN is the prime candidate. (public service)
- * If packet service is done, we would like to apply it to file transfer by DDX-C. (food)

3) The group of companies that are watching and waiting

- * We are interested, but right now we don't see what we could use it for. (service)
- * We don't know what we could use it for. No new products have been offered by manufacturers. (transport)

- * We are interested, but only faxes or telephones are sold as ISDN terminals. Also, many of the specifications of ISDN itself are unclear. (chemicals)

(5) Problems with ISDN

The points raised by almost all the companies fall into the following two areas.

1) Problems with ISDN service

- * The service area is small.
- * The services we want are unavailable.
- * Much of the system of fees is unclear to users.

2) Problems with ISDN equipment

- * The equipment is too expensive.
- * Except for fax and teleconferencing, there is no standardized equipment.
- * In teleconferencing there is no compatibility among manufacturers.
- * There is little variety in types of terminals that handle ISDN.
- * Adaptors are insufficient.

All the companies cited the small service area and high equipment cost as problems, and these are the main impediments to the wider use of ISDN.

Another problem brought up is that legal restrictions on voice communication are too strict.

(6) Direction of ISDN popularization

Many companies, even quite large ones, are introducing ISDN on a trial basis and looking for effective ways to use it. But even when it is found to be effective, companies are having second thought about introducing it, because the places they want to use have no access points or because the equipment costs more than anticipated.

The high degree of corporate interest in ISDN shows that it will spread rapidly once the environmental conditions for its introduction are right. Users view ISDN with a leary eye, and unless ISDN can offer advantages that win them over, the popularization of ISDN will be no easy matter. This calls for an early resolution of its problems. Specifically, it is essential that ISDN offer services of obvious utility and that low-cost equipment be available. Standardization of teleconferencing systems will also help bring ISDN into wider use. If this is done on a continuous basis through the efforts of NTT and the various manufacturers, it is expected that the use of ISDN will spread, beginning with the fields of backup lines, G4 facsimiles, and teleconferencing.

Tables 3-4 through 3-6, which are divided according to the degree of enthusiasm for ISDN, summarize how companies are responding to ISDN and what problems they face, and what they want of ISDN.

Table 3-4. Group of Companies That Have Introduced ISDN

Industry to which the company belongs	How the company is dealing with ISDN and the problems it faces	What is wanted of ISDN
Transport	<p>This fiscal year we set up 14 lines of Net 64 as backup lines for our high-speed digital lines.</p> <p>We are thinking of also setting up Net 1500 for 1.5 Mbps and 384 Kbps and Net 64 for G4 faxes. This is because fax use is very heavy, such as in the air freight division, and because many divisions require quick response.</p> <p>On the 1500, dealing with TDM, etc. is slow. If this is solved, the shift from 64 to 1500 will go smoothly, but in the voice system there will still be the public-private-public problem.</p>	<p>We would like to see revision of the legal system to allow public-private-public.</p> <p>Also, we would like to have specific proposals from manufacturers for ISDN applications.</p>
Gas	<p>We introduced ISDN in spring 1989 as a trunk-line backup. We are also thinking of teleconferencing and G4 faxes, but cost considerations have prevented that.</p> <p>In teleconferencing there is no compatibility among manufacturers.</p>	<p>We would like NTT to offer many types of ISDN equipment.</p> <p>We hope that NTT will allow the flexible partitioning of channels used on the 1500. Also, the D channel specifications should be made public so that users can devise applications.</p>
Construction	<p>We are currently using 16 lines as backup. We plan to add 6 more lines to this.</p> <p>We are considering teleconferencing, but there is the problem that connection can be made only between equipment from the same manufacturer, so we have decided against this.</p> <p>It cannot be used much because there are so few access points.</p>	<p>We want the number of access points increased rapidly.</p>

Table 3-4 (Continued)

Industry to which the company belongs	How the company is dealing with ISDN and the problems it faces	What is wanted of ISDN
Transport	<p>We have set up Net 64 on a trial basis and are now studying it. By the end of this fiscal year we plan to introduce Net 1500.</p> <p>The service area is a problem; in particular, we can't use it for Narita. The ISDN equipment is too expensive.</p>	<p>We would like to see low-cost terminals that offer some attraction.</p>
Public service	<p>At present we have both ISDN and DDX-P between terminal and host, but in the future we want to have just ISDN. For the present Net 64 is enough.</p>	<p>We would like to see an early implementation of packet switching service. DDX should be done away with, and development should concentrate on ISDN.</p>
Insurance	<p>At present we use Net 64 for backup (an ISDN version of our former DDX-C); this is done to eliminate trouble and reduce cost. For the present we are thinking of expanding it. Other applications are in the planning stage.</p>	<p>The service area should be expanded and the cost of terminal equipment brought down.</p>
Financing	<p>We are a leading-edge user, having been involved in INS experiments from the beginning and having received an award from NTT. We use 50 Net 64 lines and 4 Net 1500 lines for cameras and G4 facsimiles to deal with trouble in the CD corner. We also plan to use them for backup. There are few terminals and regions covered.</p>	<p>The problem of too few terminals and regions covered should be solved urgently.</p>
Foods	<p>We introduced 8 lines of Net 64 in September 1989. We use them as backup lines for our high-speed digital lines and as a replacement for our DDX network.</p>	<p>We hope that versatile terminals will become available. We also hope that a large number of venture businesses will appear and offer a variety of services, rather than having an industry dominated by large companies.</p>

Table 3-4 (Continued)

Industry to which the company belongs	How the company is dealing with ISDN and the problems it faces	What is wanted of ISDN
Service	<p>At present we have introduced one line, on a trial basis. We also plan a switch from telex to ISDN in the way reservation status is reported from the inns and hotels we do business with.</p> <p>Besides access points and other service-area problems, in many instances the content of the services and the fees for them are unclear to users.</p>	We would like NTT to explain everything about ISDN to users in a way they will understand. We would like manufacturers to sell equipment with which the terminals can be used with ISDN too.
Commercial business	<p>Mainly as a backup for our DID lines, we are putting in 11 nodes and 20 lines of Net 64 and 3 nodes and 6 lines of Net 1500.</p> <p>Today's computers have no ISDN interface, impose many restrictions, and make it impossible to obtain full use from ISDN. ISDN terminals are expensive. Using a terminal adaptor does not allow one to take full advantage of ISDN.</p>	Packet switching service should be implemented at an early date.
Commercial business	We have installed lines, but there are no prospects for applications in specific uses.	The price of terminals should come down. It would also be nice to have adaptors.
Financing	We have introduced an ISDN as backup for our packet switching network and are studying how best to use it. We will use it a great deal if there are applications that look useful. Now it only contributes to lowering line costs.	None in particular.
Chemicals	We are doing G4 faxing and teleconferencing with Net 64. We intend to continue using it actively.	We'd like terminals to be cheaper.

Table 3-4 (Continued)

Industry to which the company belongs	How the company is dealing with ISDN and the problems it faces	What is wanted of ISDN
Rubber	We put in an ISDN in 1988 on a trial basis and are studying it. We are also thinking of using for ISDN either a backup line or a dedicated line, whichever has less traffic. Adaptors and specialized terminals are very expensive.	The above problems should be solved, and an environment should be created that makes it easy for users to put in an ISDN.

Table 3-5. Group of Companies Planning the Introduction of ISDN or Actively Introducing It

Industry to which the company belongs	How the company is dealing with ISDN and the problems it faces	What is wanted of ISDN
Machinery	We want to start with one that is actually useful. Now we actually carry out CAD tele-communication using a dedicated line. If it is successful, we are thinking of also having a system that can be used with ISDN. ISDN equipment today is too expensive to be affordable.	We'd like to see the price of the equipment come down.
Distribu-tion	We are now contemplating installing an ISDN, to be used only for trunk-line backup and data transfer. There are few access points. Also, one cannot convert from DDX-C to ISDN.	The above problems should be solved quickly.
Machinery	We want to convert to public lines between head office and factory beginning with ISDN. Because of the service area problem, we cannot convert to ISDN. Also, equipment prices are high. We also have misgivings about the reliability of the lines themselves.	Solution of the above problems. Regulations should not be too strict, and as much free competition between manufacturers should be promoted as possible.

Table 3-5 (Continued)

Industry to which the company belongs	How the company is dealing with ISDN and the problems it faces	What is wanted of ISDN
Insurance	We are contemplating using it for G4 faxes, as a backup circuit, and as a network between head office and branches (we presently use public lines).	The service area should be expanded, more types of terminals should be offered, and prices should be lowered.
Public service	We plan to change over our financial online system from the present dedicated line to public lines in fiscal 1992, and ISDN is the prime candidate.	Net 64 service should be developed nationwide soon.
Electric power	We are planning to install an ISDN in fiscal 1991. The specific applications have not yet been decided.	We'd like to see a wider service area and a greater variety of terminal equipment.
Chemicals	We intend to actively use ISDN. It will be used as a backup line and for G4 faxes. Service by manufacturers is not good. In some cases connection cannot be made even by an adaptor on existing terminals.	NTT should show strong leadership to manufacturers. ISDN should be brought to the same added-value service level as DDX.
Steel	We are thinking of using it as substitute and backup for dedicated lines in G4 faxes, teleconferencing, and RCS business. Except for faxes and teleconferencing there is no standardized equipment. They are especially few in relation to EDP. The equipment is too expensive.	Packet service should be implemented soon. There should be a system whereby the user can freely use the circuit in the way desired. At present voice communications are strictly regulated, making backup and resale of voice communications difficult; there should be deregulation.

Table 3-5 (Continued)

Industry to which the company belongs	How the company is dealing with ISDN and the problems it faces	What is wanted of ISDN
Food	<p>We would like to apply packet service to file transfer by DDX-C. We are also thinking of the use of backup circuits.</p> <p>Because the equipment presently used does not have the I interface, we must depend on the terminal types. But these have not been expanded.</p>	<p>Better equipment should be provided, as well as ISDN service. The NTT menu of services seems to stop at the Ministry of Posts and Telecommunications level. The ministry should conduct its administration from the standpoint of the user.</p>
Food	<p>We are thinking of using in the future; for high-speed digital circuit back up and outside connection.</p>	<p>Net 1500 service on a nationwide level. One should be able as much as possible to use existing equipment.</p>
Machinery	<p>It will be introduced on a trial basis in early 1990.</p> <p>Many of our places of business, being located outside cities, lie outside of the service area. The ISDN equipment is very expensive.</p>	<p>We hope for solution of the above problems and connection with DDX networks.</p>
Precision devices	<p>If packets are supported, it will be used as a substitute for DDX-P. A data and voice digital one-ring network will be built by coupling with telephone terminals. We want to use G4 facsimiles on the place-of-business level.</p>	<p>Packet service should be offered soon.</p>

Table 3-6. Group of Wait-and-See Companies

Industry to which the company belongs	How the company is dealing with ISDN and the problems it faces	What is wanted of ISDN
Service	We are not contemplating installation of an ISDN because the use environment is not in order.	The service area should be expanded.
Service	We are interested in ISDN, but there is nothing that we could use it for at present. The price of the equipment is too high.	We'd like to see attractive terminals offered at low price.
Electric power	We have hopes for ISDN, because it can be used for connection with outsiders.	The terminal equipment costs too much, so prices should be reduced quickly.
Transport	We don't know what we can use it for. Manufacturers are not offering new products. The products cost too much. And manufacturers are responding slowly.	The above problems should be solved quickly.
Chemicals	We are aware of this, but only faxes and telephones are sold as ISDN terminals. Also, much about the ISDN specifications themselves is unclear. We have no specific plans to introduce ISDN.	It should be made clear how to use ISDN itself and what advantages it offers.
Commercial business	We are thinking of it as a gift house electronic catalog device, but we have not introduced it.	We feel that there are problems with the manufacturers' attitude toward terminal equipment.
Insurance	We are aware of ISDN, but at this stage we are not even looking into it. For the present one can say that there are virtually no applications.	The service area should be expanded.

Table 3-6 (Continued)

Industry to which the company belongs	How the company is dealing with ISDN and the problems it faces	What is wanted of ISDN
Service	We are not looking into it. Maybe, as a possibility, it could be used for remote monitoring in home care.	The service area should be expanded.
Public service	We are not thinking of actively doing anything in this area.	We have no particular expectations; we are waiting and watching.
Precision devices	We are aware of ISDN but have no specific plans. Because of cost, DDX-C should be usable as a substitute for it. There is no service in the region we want to use.	The service area should be expanded and the prices of terminals lowered.
Public service	We have no plans to introduce ISDN, because its data volume is low and its service area is not very extensive.	We have no particular wishes concerning ISDN.
Food	We have no specific plans to introduce it. We are watching the situation.	Packet switching service should be implemented soon.
Transport	We are aware of ISDN, but at its present level it does not offer any great advantages for our company.	There are no terminals available that seem attractive. ISDN will not become popular unless there are specific ways to use it that will convince users of its advantages.
Precision devices	We would like to put it to use, but the service area has not reached a practical level, nor are there any products that seem useful, and even if there are, they are expensive.	We would like to see nationwide service and specific products made available.

3.3 Summary

(1) Protocol standardization

In recent years, individual computer manufacturers have found it very difficult to provide all the products wanted by users, and more and more companies are turning to multiple vendors when installing information telecommunications equipment.

This multi-vendor trend is made evident by this survey, which found the following percentages of companies and organizations in the following categories:

1) Have installed information telecommunications equipment from multiple vendors	67.9%
2) Use host computers by two or more manufacturers	35.0%
3) Use terminals or workstations made by multiple manufacturers	49.9%
4) Will become a multi-vendor shop within five years	42.4%
Will become a multi-vendor shop in six to 10 years	28.6%

Among these companies, protocol considerations were especially prominent, as shown by the following:

5) Have had trouble in connecting equipment of different types	77.3%
6) Where trouble has been experienced in connecting equipment of different types (multiple replies)	
* Protocols	73.6%
* Interfaces	28.2%
* Insufficient know-how by personnel	35.6%
* Coordination between manufacturers	25.2%

Almost all the companies and organizations feel a need for protocol standardization: 83.1 percent in the questionnaire survey, and 97.8 percent in the interview survey. And the more EDP personnel there are, the stronger this trend is. This indicates that companies that build and run large information telecommunications networks feel the need for protocol standardization more keenly.

(2) Standard protocols

The majority of the companies and organizations are considering as protocols for standardization protocol specifications based on manufacturers' architectures. Only a few of them have enacted OSI-based standardization conventions (30 out of 343 companies, or 8.7 percent, in the questionnaire survey, and nine out of 45 companies, or 20.0 percent, in the interview survey). But in the questionnaire survey the great majority listed the following as reasons for not introducing OSI:

1) Few devices support OSI	124 companies
2) Don't see any advantage in OSI	93 companies
3) Not clear that OSI is wave of the future	85 companies

These responses indicate that the problem can easily be solved by increasing the number of devices that support OSI and by educational activities to popularize OSI. Also, a great latent need for OSI was revealed by the responses to the question "What do you want of OSI?" (multiple responses):

1) Quick standard-setting for the undefined portion	150 companies
2) Greater diversity of OSI-compatible equipment	188 companies
3) More OSI educational activities	81 companies

(3) Direction of OSI popularization

The results of these surveys show that while almost all companies feel a need for protocol standardization, only a few, 8.7 percent, are specifically studying the adoption of OSI as a standard protocol. But in view of the facts that

- 1) the standardization of OSI had not been completed, and
- 2) at present only a portion of the OSI products have come to market,

it can be said that "interest in the adoption of OSI is high." In any case, almost all the companies and organizations

- 1) feel a need for protocol standardization,
- 2) pay attention to OSI trends, even though at present many companies are using protocols based on manufacturers' architectures, and
- 3) will study the adoption of OSI as a standard protocol depending on the development of OSI standardization and how well manufacturers support it.

But

- 1) users want to use OSI products to make up for their shortage of specialized personnel, and thus more and better OSI products are needed, and
- 2) specific plans are needed for making the transition from existing systems to systems that make use of OSI.

As these conditions are satisfied, OSI will develop as a practical alternative.

(4) What users are doing about ISDN

Users are very aware of ISDN. The interview survey shows that a little more than 30 percent of users already use it in one form or another, and 70 percent of those answering the questionnaire survey intend to use it some time in the future. The fact that ISDN is used mainly for G4 facsimiles and file transfer indicates that its attractions are ease of use and efficiency.

(5) Future trends in the adoption of ISDN

What the questionnaire and interview surveys revealed is that the greatest key to the future popularization of ISDN will be the expansion of service to areas where many would-be users are located, and major price reductions in terminal equipment. Another major requirement is in what form to offer services so as to attract users. Users are selective about data equipment, and their basic thinking is to adopt something that will be useful and justify its cost. At present the popularization of ISDN is in its initial stage, and these conditions cannot be said to obtain.

Even large companies are sometimes puzzled about what ISDN is good for. But companies have an abiding interest in adopting ISDN, and if NTT provides a better ISDN network and the various manufacturers increase the performance and lower the price of their ISDN equipment, it seems that the adoption of ISDN will steadily expand, beginning with the fields of file transfer, G4 facsimiles, and high-speed personal computer telecommunications.

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